CLAIMS

1. A device for performing electron-ion fragmentation reactions comprising:
(a) a multi-electrode structure,
(b) a generator delivering radiofrequency voltages to the multi-electrode structure to form an electric multipolar radiofrequency field,
(c) an ion source delivering ions into the radiofrequency field, where the ions are confined in a spatially limited region by the radiofrequency field for at least some period of time,
(d) a magnetic field source for superimposing a magnetic field on the electric radiofreqency field, and
(e) an electron source for providing electrons with energies below approximately 20 electronvolts into said spatially limited region.

2. Device according to Claim 1 wherein the multi-electrode structure consists of straight rods.

3. Device according to Claim 2 wherein the multi-electrode structure consists of four parallel straight rods.

4. Device according to Claim 1 wherein the multi-electrode structure consists of ring and end cap electrodes.

5. Device according to Claim 4 wherein the multi-electrode structure consists of one hyperbolicly shaped ring and two hyperbolicly shaped end cap electrodes.

6. Device according to Claim 1 wherein the ion source delivers multiply charged ions.

7. Device according to Claim 6 wherein the ion source is an electrospray ion source.

8. Device according to Claim 1 wherein the ion source comprises an ion selector for selecting ions with respect to their mass-to-charge ratio.

9. Device according to Claim 1 wherein an additional generator delivers AC or DC voltages to the multi-electrode structure to eject ions of preselected mass-to-charge ratios.

10. Device according to Claim 1 comprising a damping gas source to deliver a damping gas to the multi-electrode structure to damp the motion of the ions and to form a cloud of ions in the center of the multi-electrode structure.

11. Device according to Claim 1 wherein the electron source comprises an electron emitter.

12. Device according to Claim 11 wherein the electron emitter is located within the magnetic field in such a way that the electrons can reach locations near the center of the multi-electrode structure by following the magnetic field lines.

13. Device according to Claim 1 wherein the electron source comprises a voltage generator delivering an acceleration voltage for the electrons.

14. Device according to Claim 13 wherein the voltage generator comprises an electron pulser for pulsing the electrons whereby the time of pulses may be locked to the phase of the radiofrequency voltage.

15. Device according to Claim 1 wherein the electron source comprises a pulse laser for generating electrons in short pulses.

16. Device according to Claim 1 wherein the magnetic field is generated by one or more permanent magnets.

17. Device according to Claim 1 wherein the magnetic field is generated by electric current through one or more coils.

18. A method of obtaining efficient ion-electron reactions comprising the steps of:
(a) providing a multipolar electric radiofrequency field for storage or guidance of ions,
(b) providing positive or negative ions in a spatially limited region inside the radiofrequency field where the ions are confined at least some period of time;
(c) providing electrons inside said region with kinetic energies of the electrons below approximately 20 eV, to allow ion-electron reactions; and
(d) providing a magnetic field inside said region sufficiently strong to confine the motion of said electrons in the direction perpendicular to said magnetic field.

19. The method according to Claim 18 wherein a force field assists in directing and guiding the electrons produced outside the spatially limited region into said region.

20. The method according to Claim 18 wherein the electrons are provided within a small time window of a few nanoseconds, the time being locked to the phase of the radiofrequency voltage.